BS in Chemical Engineering (392150) MAP Sheet
Engineering, Chemical Engineering
For students entering the degree program during the 2021-2022 curricular year.

### University Core and Graduation Requirements

<table>
<thead>
<tr>
<th>University Core Requirements</th>
<th>Suggested Sequence of Courses</th>
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<td><strong>University Core Requirements:</strong></td>
<td><strong>FRESHMAN YEAR</strong></td>
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<tr>
<td>Requirements</td>
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<tr>
<td>Religion Cornerstones</td>
<td>1</td>
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<tr>
<td>Teachings and Doctrine of The Book of Mormon</td>
<td>1</td>
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<tr>
<td>Jesus Christ and the Everlasting Gospel</td>
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<tr>
<td>Foundations of the Restoration</td>
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<tr>
<td>The Eternal Family</td>
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<tr>
<td><strong>Total Hours</strong></td>
<td><strong>2nd Semester</strong></td>
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<tr>
<td><strong>American Heritage</strong></td>
<td>1</td>
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<tr>
<td><strong>Total Hours</strong></td>
<td><strong>2nd Semester</strong></td>
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<td><strong>Skills</strong></td>
<td><strong>3rd Semester</strong></td>
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<td>First Year Writing</td>
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<td>Advanced Written and Oral Communications</td>
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<td>Quantitative Reasoning</td>
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<td>Languages of Learning (Math or Language)</td>
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<tr>
<td><strong>Arts, Letters, and Sciences</strong></td>
<td><strong>4th Semester</strong></td>
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<tr>
<td>Civilization 1</td>
<td>1</td>
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<td>Civilization 2</td>
<td>1</td>
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<tr>
<td>Arts</td>
<td>1</td>
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<tr>
<td>Letters</td>
<td>1</td>
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<tr>
<td>Biological Science</td>
<td>1</td>
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<tr>
<td>Physical Science</td>
<td>2</td>
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<tr>
<td>Social Science</td>
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<tr>
<td><strong>Total Hours</strong></td>
<td><strong>5th Semester</strong></td>
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<td><strong>Core Enrichment: Electives</strong></td>
<td><strong>6th Semester</strong></td>
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<td>Religion Electives</td>
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<td>Open Electives</td>
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<td><strong>6th Semester</strong></td>
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<td><strong>Total Hours</strong></td>
<td><strong>Senior Year</strong></td>
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<td><strong>Skills</strong></td>
<td><strong>7th Semester</strong></td>
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<td><strong>Arts, Letters, and Sciences</strong></td>
<td><strong>8th Semester</strong></td>
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<tr>
<td><strong>Total Hours</strong></td>
<td><strong>8th Semester</strong></td>
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</tbody>
</table>

*American Heritage can be satisfied by taking A HTG 110, ECON 110 + HIST 220, or ECON 110 + POLI 110. Since ECON 110 is required for the major, students may take HIST 220, POLI 110, or A HTG 110 to satisfy the American Heritage requirement.

**REDUCTION OF TOTAL CREDITS IS RECOMMENDED by choosing a Civilization 2 course that double counts for the Arts requirement (Civ 2/Art) and a Letters course the double counts for the Global and Cultural Awareness requirement (Lett/GCA). (You may also do a Civ 2/Lett + Art/GCA pairing.) See the University Core list for specifics (core.byu.edu).

**The department Biology requirement may be satisfied by taking one of the following courses: BIO 100, BIO 130, MMBIO 221, MMBIO 240, or PDBIO 120. Each of these also satisfies the University Core requirement for Biological Sciences. BIO 100 is introductory in nature and is not recommended for students who had biology in high school. See the department website for more information.
Due to the complex prerequisite relationships and limited scheduling of these courses, students should consult with the department about their course scheduling.

**REQUIREMENT 1**: Complete 3 options

**PROFESSIONAL COURSES**:

- **CH EN 374**: Fluid Mechanics 3.0
- **CH EN 376**: Heat and Mass Transfer 3.0
- **CH EN 378**: Science of Engineering Materials 3.0
- **CH EN 385**: Thermodynamics and Transport Lab 0.5
- **CH EN 386**: Chemical Reaction Engineering 3.0
- **CH EN 391**: Career Skills 2 0.5
- **CH EN 436**: Process Control and Dynamics 3.0
- **CH EN 445**: Separations and Process Control Lab 0.5
- **CH EN 451**: Chemical Engineering Plant Design and Process Synthesis 4.0
- **CH EN 476**: Separations 3.0
- **CH EN 479**: Unit Operations Laboratory 2.0

**PREPROFESSIONAL COURSES**:

- **GROUP 1.1**: Complete 9 courses
  - **CH EN 170**: Introduction to Chemical Engineering 2.0
  - **CH EN 201**: Preprofessional Seminar 0.5
  - **CH EN 263**: Computational Tools for Chemical Engineers 2.0
  - **CH EN 273**: Chemical Process Principles 3.0
  - **CH EN 291**: Career Skills 1 0.5
  - **EC EN 301**: Elements of Electrical Engineering 3.0
  - *MATH 112 - Calculus 1* 4.0
  - MATH 113 - Calculus 2 4.0
  - PHSCS 121 - Introduction to Newtonian Mechanics 3.0

**GROUP 1.2**: Complete 1 group

- **GROUP 1.2.1** Complete 2 courses
  - **CHEM 111**: Principles of Chemistry 1 4.0
  - **CHEM 112**: Principles of Chemistry 2 3.0

- **GROUP 1.2.2**: Complete 3 courses
  - **CHEM 105**: General College Chemistry 1 with Lab (Integrated) 4.0
  - **CHEM 106**: General College Chemistry 2 3.0
  - **CHEM 107**: General College Chemistry Laboratory 1.0

**GROUP 1.3**: Complete 1 group

- **GROUP 1.3.1** Complete 2 courses
  - **MATH 302**: Mathematics for Engineering 1 4.0
  - **MATH 303**: Mathematics for Engineering 2 4.0

- **GROUP 1.3.2** Complete 2 selections
  - **SELECTION 1.3.2.1**: Complete 1 course
    - MATH 213 - Elementary Linear Algebra 2.0
  - **SELECTION 1.3.2.2**: Complete 2 courses
    - MATH 314 - Calculus of Several Variables 3.0
    - MATH 334 - Ordinary Differential Equations 3.0

**REQUIREMENT 2**: Complete 15 courses

**OPTION 4.1**: Complete 2.0 hours from the following course(s)

- **CHEM 353**: Organic Chemistry Laboratory—Nonmajors 2.0v
- **CHEM 464**: Physical Chemistry Laboratory 1 1.0
- **CHEM 465**: Physical Chemistry Laboratory 2 1.0

**OPTION 4.2**: Complete 9 hours of approved advanced engineering (ENG) course work. In general, these courses are 300-level or above or from any of the following departments: Chemical Engineering; Civil & Environmental Engineering; Electrical & Computer Engineering; Mechanical Engineering; or the School of Technology. For details and exceptions, see the department webpage.

**OPTION 4.3**: Complete 4 hours of approved advanced course work from an engineering, math, science, or business (EMSB) department. In general, these courses are 300-level or above or from any of the following colleges: College of Engineering & Technology, College of Physical & Mathematical Sciences, College of Life Sciences, and the Marriott School of Business. For details and exceptions, see the department webpage.

**REQUIREMENT 5**: Pass a basic competency exam (L3 exam) administered by the Chemical Engineering Department. All students in the chemical engineering program must pass a competency exam based on the foundational principles of chemical engineering that are taught in the program courses. The exam will be administered during the senior year with the specific dates announced each year by the Chemical Engineering Department. Each fall, the department will supply written rules, guidelines, and reference material to help students prepare to take the exam.

**THE DISCIPLINE**:

Chemical engineering is the application of chemistry, biology, physics, mathematics, computer skills, and economics to designing, developing, and implementing chemical processes that convert raw materials into more useful, valuable products. Engineering skills are required for design, testing, scale-up, operation, control, and optimization. Applications range in size from the molecular level to large chemical production facilities, with objectives ranging from economic performance to protection of the environment and the safety of workers and consumers. Chemical engineers
are engaged in developing and producing a diverse range of products from raw materials to commodity and specialty chemicals. These products include high-performance materials needed for aerospace, automotive, biomedical, electronic, environmental and military applications. Chemical engineers work in a variety of industries, including chemical manufacturing, energy, biotechnology, electronics, food, clothing, paper, healthcare, and business services.

**ACADEMIC STANDARDS POLICY:**
To help students 1) identify if chemical engineering is a good academic fit, 2) successfully complete the chemical engineering program, and 3) become technically competent engineers capable of performing professional duties in the field, the department has set the academic standards enumerated below. For this policy, major courses are defined as those used to fulfill the Program Requirements listed for a BS in Chemical Engineering in the Undergraduate Catalog and are found under subheadings preprofessional, professional, supporting, and technical electives. Since all grades earned for a course (original and retakes) are retained in university records and GPA calculations, only the most recent grades for retaken courses are considered for purposes of this policy.

1. To ensure proper preparation for and successful completion of the chemical engineering program, students must meet the following criteria to register for any upper-division professional courses (i.e. CH EN courses 300 level and above): a) Have no more than 4 total hours of less than C- credit in any preprofessional or supporting course(s) satisfying program requirements, only 3 of which can be from chemical engineering courses. b) Pass CH EN 273 with a C- or above.
2. To help correct technical weaknesses as soon as they are identified, a student who accumulates grades below C- in excess of 6 hours in any course(s) satisfying major requirements (preprofessional, professional, supporting, and technical electives) may not take further chemical engineering courses until the unacceptable credits have been reduced to 6 hours or less.
3. To demonstrate that graduates from the chemical engineering department are technically competent to perform professional duties in the field, a student may not graduate with more than 4 total hours below C- in any course(s) satisfying major requirements (preprofessional, professional, supporting, and technical electives), only 3 of which can be from chemical engineering.

**RESEARCH:**
The Department of Chemical Engineering has a highly qualified faculty with a wide range of experience in both industry and research. Many areas of research are being pursued, including: 1) converting coal to clean gaseous fuels; 2) combustion of coal and other fuels as well as rocket propellants; 3) developing new storage batteries; 4) measurement and prediction of physical, chemical, thermodynamic, and transport properties of liquids, gases, and solids; 5) molecular simulations; 6) chemical processes and materials in biological systems, including the human body; 7) catalysis, with emphasis on forming and reforming hydrocarbon fuels; 8) computer control of chemical processes; 9) sustainable energy; and 10) mathematical modeling of chemical processes and phenomena.

**INTERNSHIPS, CO-OP EDUCATION:**
Encouraged.

**HONORARY SOCIETIES AND CLUBS:**
American Institute of Chemical Engineers (AIChE), Sigma Xi, Tau Beta Pi.

**FINANCING OF EDUCATION:**
Scholarships, research assistantships, and teaching assistantships are available.

**CAREER OPPORTUNITIES:**
The combination of knowledge about process engineering, math, and chemistry obtained in the chemical engineering curriculum is a versatile preparation that opens a wide variety of opportunities to graduates. This versatility is one reason why chemical engineers have traditionally been among the highest paid professionals in the engineering and science disciplines. Chemical engineers make a significant difference in our quality of life. Some develop clean, new energy sources to power society. Some develop and produce fertilizers and other agricultural chemicals to feed mankind. Virtually all pharmaceuticals are produced by chemical engineers to enhance the life of millions. Others study and produce biomedical devices and artificial organs. Still others are involved in development and production of new materials for use in new high-tech products.

Chemical engineers produce chemicals ranging in use from cleaning products to medicines and from man-made fibers for clothing and textiles to plastics for construction and consumer goods. Another large employer of chemical engineers is the semiconductor industry. Chemical engineers assist in the design and manufacturing of semiconductor chips and circuit boards. This work involves significant knowledge of chemistry and related processes. The petroleum industry is a large employer of chemical engineers, requiring their expertise for the discovery, production, and refining of petro-chemicals including fuels, chemicals, and oils.

Many chemical engineers are employed in environmentally related positions, working on ways to improve air and water quality, to reduce acid rain and smog, and to recycle and reduce garbage. Additionally, chemical engineers are employed by universities as teachers and researchers and by government agencies to provide answers for energy, environmental, and defense concerns. Chemical engineers also train to work in the medical, business, and legal professions.

Though chemical engineering career opportunities are diverse, job functions can be categorized more easily. Chemical engineers are usually involved in research, design, development, production, technical sales, or management. In research, they develop new ideas, new products, and new ways to produce existing products more economically and with less environmental impact. In design, they create the processes that
convert raw materials into finished products with emphasis on efficiency, safety, consumer needs, and environmental protection.

The development engineer improves existing processes and technology to better meet changing needs. Production engineering involves supervision, quality control, and testing of production processes and operations. Management and technical sales involve decision making with regard to consumer needs and technical capabilities. Chemical engineers are creative problem solvers. Their careers are rewarding not only from an intellectual and financial view, but also from a personal perspective. Affecting the lives of millions, their solutions provides a better lifestyle for mankind.

MAP DISCLAIMER
While every reasonable effort is made to ensure accuracy, there are some student populations that could have exceptions to listed requirements. Please refer to the university catalog and your college advisement center/department for complete guidelines.

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Provo, UT 84602
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